



Session 628 Highways For Life The Future Is Now

**Dave Holstein
Ohio Department of
Transportation
614-644-8137**

dave.holstein@dot.state.oh.us



Work Zone Impacts

1. Capacity
2. Safety/Crashes

There is a link between capacity and crashes.



Work Zone Impacts

- 43% of all Ohio IR crashes occur on 12% of our IR system
- Of this 12%, virtually all of it is over capacity
- What does this have to do with work zones you ask?



Work Zone Impacts - Capacity

- Thanks for asking
- Work zones by their very nature reduce capacity
- Exceeding capacity causes crashes
- Work zone conditions can exasperate crashes (narrow lanes, clear zone issues, etc.)



Plan to Address WZ Capacity/Crashes

1. Developed “Maintenance of Traffic Policy” to ensure satisfactory WZ capacity - 2000
2. Developed MOT Alternative Analysis (MOTAA) to identify WZ “constraints” early in project development – 2003
3. Developed process to monitor WZ crashes in near real-time - 2004

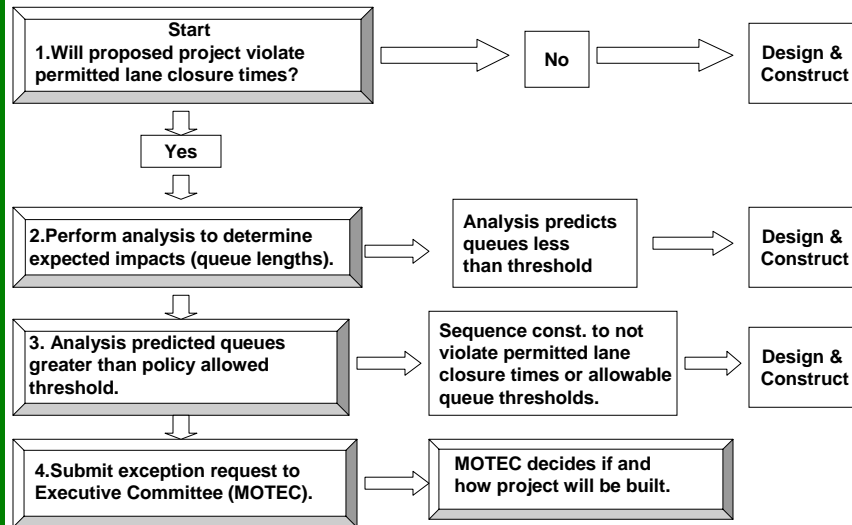


Plan to Address WZ Capacity/Crashes

1. Maintenance of Traffic Policy = Proactive
2. Maintenance of Traffic Alternative Analysis = Proactive
3. Work Zone Crash Reporting = Reactive



The Policy Process



7



The ODOT MOT Policy

- Established “Permitted Lane Closures (PLC)”
 - Hours each individual IR segment can have a lane reduction based on capacity
 - PLC times applicable to both maintenance and construction projects
- Established maximum allowable queue impacts

8



The ODOT MOT Policy

- Allowable queue thresholds
 - Queues less than 0.75 miles are acceptable
 - Queues greater than 0.75 miles and less than 1.5 miles if the queue exceeds 0.75 for two hours or less
 - 0.75 mile queues with a duration greater than 2 hours or longer than 1.5 miles are unacceptable



The ODOT MOT Policy

- Established analysis process to determine queue impacts of projects that violate PLC
 - Utilize Quez98 program/ODOT spreadsheet/adjustment factors to predict queues
- Established exception process that requires analysis of cost, schedule, queue impacts for numerous alternatives
 - Final decision is by executive committee (due to financial ramifications)

11

- 12



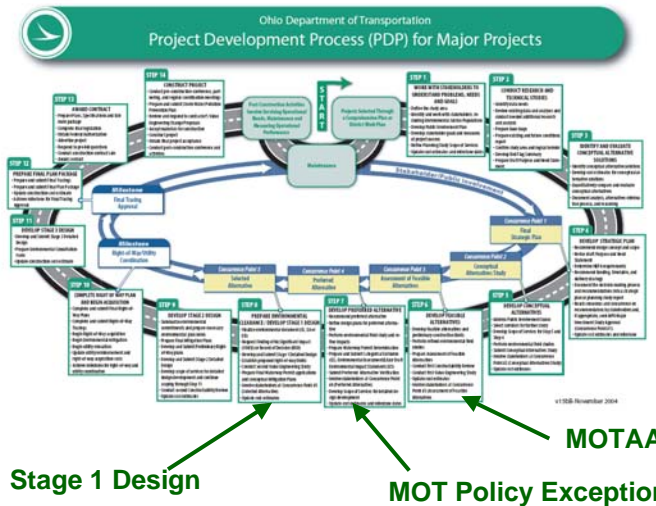
The MOT Alternatives Analysis



ODOT MOT Alternatives Analysis

- What is it?
- Analysis of potential work zone impacts “constraints” that occurs **PRIOR** to the first detail plan submissions
- It occurs early enough so that MOT can be used to:
 - Pick between feasible project alternatives
 - Size structure widths
 - Highlight WZ right-of-way and environmental impacts early enough to do something about them

ODOT MOT Alternatives Analysis



The ODOT MOTAA

- Designer is given a specific “desired” foot print (cross section) and then reports on a given list of potential problems
- The number of lanes are based on the PLC
- “Desired” foot print (cross section) is overlaid at defined location for both a crossover and part width alternatives.



The ODOT MOTAA

- Designer reports (for both crossovers and width) if any of the following problems would be expected:
 - Work zone policy
 - Maintain access (off-ramp capacity)
 - Ramp merges
 - Environmental impacts
 - Construction cost/duration
 - Maintenance of existing lighting/drainage
 - Construction joint location (concrete)
 - Crossover location
 - R/W impacts
 - Bridge widths
 - Earthwork, retaining walls, profiles
 - Constructability/ Constr. Access
 - Provide “desirable” “footprint/cross section”

17



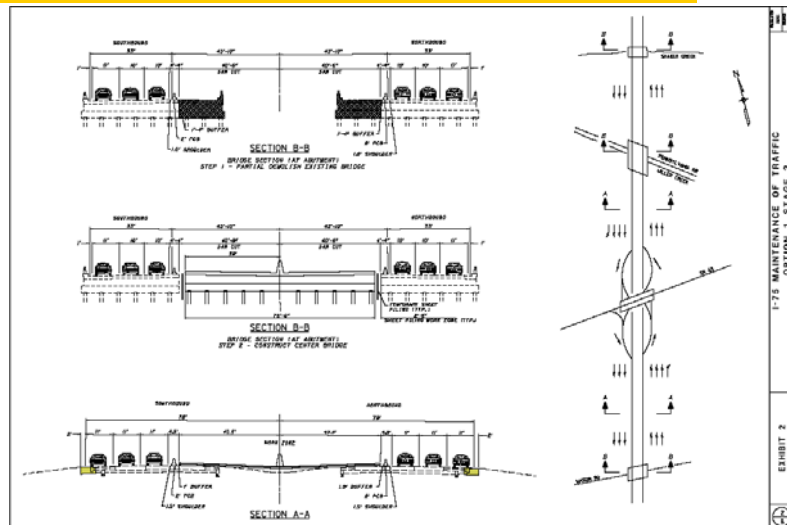
The ODOT MOTAA

Factor to be Considered	Option	
	1	2
	Partial Construction (with partial demolition at bridge)	Complete Construction (without partial demolition at bridge)
Ability to Meet Work Zone Policy	Full closure of I-75 may be required at night, during partial demolition of the structure.	Meet policy at all times.
Ability to maintain all access	Single access provided, utilizing two-step construction.	Access to SR 60 will be provided using crossovers in Stage 3.
Ability to provide on-ramp Decision Right Distances	Meet TRB requirements.	Meet TRB requirements. See ramp stage, Exhibit A through G.
Right-of-way and environmental impacts	MDOT claims would not increase R/W or environmental impacts along I-75. Additional (unused) temporary easements are anticipated along SR 60, to facilitate placement of temporary pavement for partial construction.	MDOT claims would not increase R/W or environmental impacts along I-75. Additional (unused) temporary easements are anticipated along SR 60, to facilitate placement of temporary pavement for partial construction.
Final bridge widths	MDOT claims does not impact proposed final bridge width (approx. 78.3 feet-to-face of barrier in both directions on I-75).	MDOT claims does not impact proposed final bridge width (approx. 78.3 feet-to-face of barrier in both directions on I-75).
Significant impacts for construction duration (see note 2).	Shorter construction duration on I-75. Bridges are constructed in two sequential steps, in the second construction season.	Complete Construction of I-75 median area would occur in the first construction season (with minimal impact to existing traffic). I-75. Most construction would be completed in the second construction season similar to Option 1. However, an additional one to three months would likely be required for a final construction season to complete median construction along I-75.
Significant impacts to permanent earthwork, retaining walls, etc.	No impacts to these permanent design features are anticipated.	No impacts to these permanent design features are anticipated.
Ability to maintain existing drainage and lighting systems	No special provisions required.	Temporary drainage features and ditch work will be required in Stage 2 to maintain drainage at access adjacent to access to the SR 60 interchange ramps.
Constructability and construction equipment access	Adequate and safe work zones along I-75. Potentially difficult contractor access is common with partial construction.	Improves contractor access and work space for construction of SR 60. Facilitates efficient construction zones. Design of access to and from interchange ramps becomes more complicated, although is routine work for most contractors.

18



The ODOT MOTAA



19



ODOT MOT Alternatives Analysis

- How/why did we develop this process?

It started with our Director.

20



The ODOT MOTAA – How/Why

- ODOT is embarking on the largest construction program(s) in our history
- Director was concerned about the impact our work zones will have on crashes
- Director's Question - Are the ODOT work zones causing more accidents?
 - If so, can we do more to limit the increase?

21



The “Knee Jerk” Reaction

- “Well of course we have more crashes in work zones. Narrow lanes, barriers next to lanes, and on... and on.... and on....”
- Turns out there were things we could do better!!

22



The Analysis

- Began analyzing work zone crashes
- Performed “Before/After” comparison of crash rates
- Results were startling:

23



The Analysis

Work Zone Crash Summary - 2003																
County	Route	Project	Begin SLM	End SLM	Length	Begin Month	End Month	Time Period (Days)	2003 Average ADT	Work Zone Crashes	Work Zone Rate	Work Zone Cost	Fatal	Injury	POD	
WASH	227S	227(3)	30.00	32.35	2.35	1	12	360	114,995	420	2.60	\$5,500,494	0	83	136	
CLE	27S	2(2)	4.20	9.79	5.59	1	10	267	69,120	155	1.42	\$3,634,797	1	32	122	
		17(20)	9.79	13.98	3.79	1	12	350	69,890	255	3.14	\$4,633,355	1	61	193	
BUT	007S	430(5)	0.00	6.41	6.41	03	12	269	135,453	415	1.45	\$6,771,256	0	167	389	
HAM	007S	430(5)	15.27	17.42	2.15	03	12	269	140,466	162	1.87	\$2,762,449	0	48	184	
STA	0077	300(0)	11.59	12.76	1.17	01	04	127	95,022	37	2.89	\$338,694	0	3	34	
		467(5)	12.76	14.81	2.05	05	10	190	87,148	79	2.46	\$1,233,636	0	22	57	
COT	0480	485(5)	12.81	18.30	5.49	03	9	200	159,500	157	1.11	\$2,294,626	0	42	115	
MOT	007S	500(1)	18.20	19.79	1.59	01	12	365	95,575	50	0.87	\$815,670	0	15	35	
		100(5)	19.79	21.41	1.62	03	12	269	94,161	123	2.79	\$1,678,714	0	33	96	
MED	0071	735(0)	20.40	21.40	1.00	01	04	122	17,865	12	2.60	\$289,872	0	4	8	
		235(0)	21.40	24.40	3.00	03	07	152	49,163	9	1.25	\$11,699	0	1	8	
ROC	0071	116(1)	18.90	20.40	1.50	04	11	243	40,540	20	1.35	\$1,242,207	1	4	15	
									3,257							
									AVE:	2.62	\$18,954,137					
Free Flow Comparable																
Comp. Crashes	Comp. Year	Comp. Year ADT	Comp. Rate	Percent Difference	Free Flow Cost	Fatal	Injury	POD	Cost Difference	Hot Spot	Comp. d	HSP - 1	HSP			
253	00	109,553	0.65	55%	0	40	211	0	0	Y	19	52	124			
106	00	79,100	0.86	65%	0	33	73	0	0	Y	242	336	340			
115	00	60,900	1.30	125%	0	24	90	0	0	Y	30	160	11			
112	02	129,109	1.30	2%	0	51	751	0	0	Y	30	160	11			
136	02	135,303	0.62	10%	0	27	100	0	0	Y	30	160	11			
22	99	52,279	1.80	61%	\$379,229	0	6	16	\$1,134	Y	18	—	107			
20	99	19,664	6.81	186%	0	1	16	16	\$17,269	Y	—	—	—			
101	02	153,809	0.94	51%	0	27	74	0	\$54,500	Y	212	320	143			
40	02	98,670	0.84	4%	\$802,739	0	15	33	\$12,900	Y	40	507	133			
75	02	52,077	1.65	69%	0	24	47	0	\$6,318	Y	—	—	—			
4	99	40,966	1.80	100%	\$97,956	0	2	7	\$110,919	N	—	—	—			
8	99	53,260	0.99	22%	\$197,396	0	2	6	\$35,248	N	—	—	—			
10	00	42,380	0.65	100%	\$195,912	0	4	6	0	N	—	—	—			
									AVE:	1.11	0	—	—			
									Free Flow Rate: 1.11	Free Flow Cost: \$1,134						

Work Zone Rate

No Work Zone Rate

24



The Analysis

Work Zone Crash Summary - 2002																
CD	RTS	Project No.	Begin Date	End Date	Length	Begin Month	End Month	Time Period (Days)	Average ADT	Work Zone Length	Work Zone Rate	Work Zone Cost	Fatal	Injury	Property	ROI
HMA	275	30700	10/20	10/20	4.17	03	12	324	113,100	176	1.27	\$1,579,718	0	26	188	
		307100	10/20	10/20	3.20	04	12	274	84,941	163	2.89	\$1,988,468	0	26	137	
CLE	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
		265	4/20	9/70	4.50	03	12	304	71,188	143	1.88	\$1,823,118	0	31	309	
		17500	9/70	12/31	3.30	06	12	213	60,300	100	2.86	\$1,326,378	0	21	79	
MA	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
MED	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
STA	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
ASC	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
SLM	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
AV	275	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
LVC	280	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
SLM	280	307100	03/01	4/20	4.20	04	12	274	86,397	158	1.32	\$1,523,888	0	26	118	
Free Flow Comparable																
Comp. Count	Comp. Year	Comp. Rate ADT	Comp. Rate	Percent Difference	Free Flow Cost	Fatal	Injury	Property	ROI	Cost Difference	Hot Spot	Comp. #	HSP - I	HSP - II		
130	00	100,363	8.95	23%	1,000,000	1	35	94	4,891,375	Y	19	52	120			
120	00	79,635	1,72	22%	1,000,000	1	30	89	4,891,375	Y	14	36	148			
80	00	82,180	8.76	43%	1,000,000	0	17	43	4,891,375	Y	24	36	148			
120	00	75,107	1,83	13%	1,000,000	0	32	97	4,891,375	Y	19	52	120			
70	00	60,895	1,54	26%	1,000,000	0	16	48	4,891,375	Y	19	52	120			
100	99	81,111	8.87	47%	1,000,000	1	25	77	4,891,375	Y	22	40	107			
104	99	43,116	8.87	47%	1,000,000	0	34	112	4,891,375	Y	19	52	120			
132	99	103,739	2.46	26%	1,000,000	0	11	42	4,891,375	Y	19	52	120			
171	99	42,732	8.47	66%	1,000,000	0	2	10	4,891,375	Y	19	52	120			
102	99	43,089	8.74	56%	1,000,000	0	3	7	4,891,375	Y	19	52	120			
99	00	59,128	1.28	10%	1,000,000	0	26	73	4,891,375	Y	19	52	120			
100	01	43,035	8.44	54%	1,000,000	0	3	7	4,891,375	Y	19	52	120			
171	02	43,360	8.44	54%	1,000,000	0	7	18	4,891,375	Y	19	52	120			
571	02	52,801	8.55	57%	1,000,000	0	17	46	4,891,375	Y	20	37	148			
302	99	52,216	8.92	37%	1,000,000	0	6	26	4,891,375	Y	20	37	148			
Ave																
New Cost: \$16,000																

Work Zone Rate

No Work Zone Rate

25



Next Step→ More Analysis→ The Conclusions

Geometrics

The “abnormally” high concentrations of crashes showed there are major geometric contributing factors to work zone crashes:

- (a) Inadequate off-ramp capacity (not covered by MOT policy)
- (b) Inadequate ramp merges
- (c) Insufficient paved shoulders

26



The Geometric Problems

- Ramp merges – Created new standards for work zone on ramp merges. Merges are now required to be detailed in plans. (Problems noted in MOTAA)
- Paved shoulders – Created “desired” cross section that requires a 2’ paved shoulder (Problems noted in MOTAA)
- Off ramp capacity – Explicitly looked for in Maintenance of Traffic Alternative Analysis (MOTAA).

27



The ODOT MOTAA

- So what does all this have to do with the MOTAA?
- The MOTAA is also a process that ensures we won’t replicate the geometric problems discovered through our crash analysis

28



The ODOT MOTAA

Net Result:

- Past problems don't get replicated
- Potential WZ problems are identified early in the project development process when there is still time to take action
- Identifies "best" option for a WZ (part width, crossover, contra flow, hybrid)
- Problem "fixes" are scoped into the subsequent detail design steps of the process
- Identifies important innovative contracting opportunities

29



Work Zone Crashes



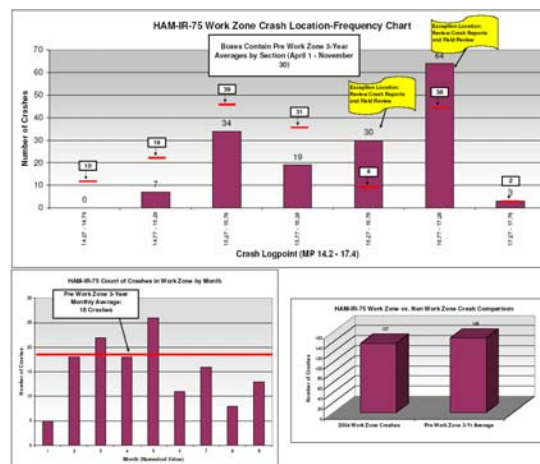
Work Zone Crashes – Reactive Measures

- ODOT is obtaining work zone crash reports in nearly real time from local law enforcement.
- Crashes are input into a database application that sorts crashes into one half-mile segments for comparison to historical pre-construction average crash frequency.

31



Work Zone Crashes – Reactive Measures



32



Work Zone Crashes – Reactive Measures

- Work zone crash reports are used to look for “abnormally” high concentrations of crashes.
- When found field visit ensues to find causes and fixes.

33



Misc. MOT Topics



Related MOT Topics

OPI

- Every Interstate and look-alike work zone is inspected and rated by Central Office for adherence to standards, specifications and for safety concerns
 - Any safety concerns are immediately brought to the attention of the district for correction
 - Results of these inspections are part of Organization Performance Index (OPI)
 - Each District Deputy Director is held accountable for their OPI performance

35



Related MOT Topics

Training

- ODOT undertaking largest training initiative in our history
 - One of the many required classes (for 2500 ODOT highway workers, project inspectors, etc) is work zones
 - Testing and certification are part of the training classes
- Consultants now required to attend ODOT WZ Design training class as part of their prequalifications. Testing & certification required.

36



Misc. MOT Topics

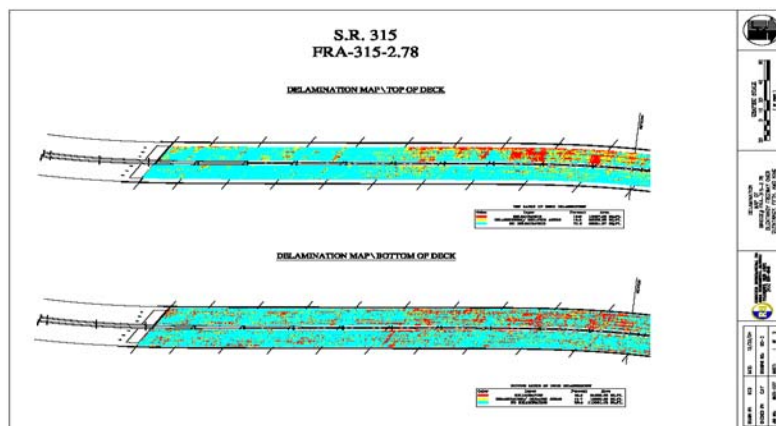
- More open to complete closures; particularly for urban bridge overlays.
- Maximum deck area is currently 23,000 square feet
 - Close Friday @ 8 pm
 - Open for Monday rush hour
 - Must be cautious of “blow throughs”

37



Misc. MOT Topics

- Ground Penetrating Radar



38



QUESTIONS?

